Universal relation listed all the data items required for the application.

Then we apply 1NF. We removed repetitive data, make sure that each cell contains one single value.

Then move on to 2NF. We define the primary key, and partition the table to make sure all the attributes are fully functionally dependent.

Then move on to 3NF. We divide our table again, to make sure there has no transitive functional dependencies.

1NF

Member Information

Member_ID	Member_Name	Email_address	Identity	Loan_Credit	Available_Loans	Borrowing_Copies

Loan Information

Loan_Record_Number	Member_ID	Item_ID	Lending_Date	Due_Date	Return_Date	Expired_Days	Overdue_or_not	Fine

Item Information

Item_ID	Item_name	Type	Loan_period

Item Inventory

Item_Name	Loan_period	Total_stock

Item Location

Item_Name	Floor	Shelf	Class

Reservation Information

Reservation_Record_Number	Member_ID	Item_ID	Reservation_Date	Time_Remaining_for_pick_up	Number_of_refusals

Account Status

Loan_Record_Number	Item_ID	Member_ID	Fine

Member_ID	Total_Fine	State

2NF

Member Information

Member_ID	Member_Name	Email_address	Identity	Available_Loans	Borrowing_Copies

Identity	Loan_Credit

We can derive Loan_Credit from Identity, so Loan_Credit doesn't depend on Member_ID.

Loan Information

Loan_Record_Number	Member_ID	Item_ID	Lending_Date	Due_Date	Return_Date	Expired_Days	Overdue_or_not	Fine

Item Information

Item_ID	Item_name	Type	Loan_period

Item Inventory

Item_name	Type	Loan_period	Total_stock

Item Location

item_name	Floor_number	Shelf_number	Class_number

Reservation Information

Reservation_Record_Number	Member_ID	Item_ID	Reservation_Date	Time_Remaining_for_pick_up	Number_of_refusals

Booking Entries

Loan_Record_Number	Item_ID	Member_ID	Fine

Account State

Member_ID	Total_Fine	State

3NF

Member Information

Member_ID	Member_Name	Email_address	Identity	Borrowing_Copies

Member name, Email address, identity and borrowing copies are all depend on member id, which means no transitive dependency exists.

Identity	Loan_Credit

A member's identity determines how many books he can borrow, i.e., loan credit. No transitive dependency here.

Loan Information

Loan_Record_Number	Member_ID	Item_ID	Lending_Date	Due_Date	Return_Date

Member ID, Item ID, Lending Date, Due Date, Return Date all correspond with Loan Record Number, which means no transitive dependency exists here.

Expire Information

Item number	Due_Date	Return_Date	Lending_Date	Expired_Days	Overdue_or_not	Fine

Due date, return date, lending date, expired days, overdue or not and fine are fully dependent on item number, which means there is no dependency here.

Item Information

Item_ID	Item_name	Stock state

Item name and stock state fully dependent on item id, so there is no transitive dependency here.

Item Inventory

Item_name	Type	Loan_period	Total_stock

Type, loan period, total stock are dependent on item name, so there is no transitive dependency here.

Item Location

item_name	Floor_number	Shelf_number	Class_number

Floor number, shelf number, class number are all dependent on item name. So there is no transitive dependency here.

Reservation Information

Reservation_Record_Number	Member_ID	Item_ID	Reservation_Date	Number_of_refusals

Member id, item id, reservation date, and number of refusals are all correspond with reservation record number, so there’ s no transitive dependency here.

Reservation Act

Reservation_Record_Number	Act_Date	Accept_Or_Refuse

Act date and accept_or_refuse are dependent on reservation record number. So no transitive dependency exits.

Account State

Member_ID	Total_Fine	State

Total fine and state all depend on member ID.